

REMARKS

Reconsideration of this application is respectfully requested.

Claims 1, 3, 6, 7 and 18 have been amended, claims 4, 5, 11 and 13-16 have been cancelled without prejudice or disclaimer, and new claim 26 has been added. Upon entry of this amendment, the pending claims will be claims 1-3, 6-10, 12 and 17-26.

Recitations of claims 4, 11, 15 and 16 have been inserted into claim 1.

The dependency of claim 3 has been changed.

Recitations have been deleted from claims 6, 7 and 18.

New claim 26 recites the presently elected species.

As indicated on page 2 of the Official Action, claims 4, 5, 9, 14, 17-19, 21 and 23-25 are withdrawn from further consideration.

Claims 4, and 17-19 should be rejoined as also reading on the elected species.

For the reasons given on page 2 of the Official Action, claim 16 is rejected under 35 USC 112, first paragraph.

This rejection is respectfully traversed.

The subject matter of claim 16 is supported by the passage of the present specification extending from page 10, line 23 to page 11, line 24. The Ohnishi and Hiwara patents refer to various sulfonium salts by the trade name "Sanaid", whereas the present specification apparently refers to these compounds by the trade name "Sun Aid". However, in U.S. Patent No. 6,376,070, these

compounds are apparently referred to by the trade name "SUNAID". See the attached passage, obtained from the USPTO website for US 6,376,070.

Therefore, the present specification would appear to provide one skilled in the art with sufficient information to select the proper compounds, especially since Example 3 on page 67 of the present specification identifies Sanshin Chemical Co., Ltd. as the manufacturer of these compounds.

Accordingly, there would not appear to be sufficient grounds to reject claim 16 under 35 USC 112, first paragraph.

For the reasons given on pages 2 and 3 of the Official Action, claim 7 is rejected under 35 USC 112, second paragraph.

In the Official Action it is stated that there is no antecedent basis for the curing accelerator component in line 3.

This rejection is obviated by the attached proposed amendment, wherein the dependency of claim 3 has been changed from claim "1" to claim --2--.

Accordingly, the rejections under 35 USC 112 should be withdrawn.

For the reasons given on page 3 of the Official Action, claims 1, 3, 6-8, 13, 15 and 20 are rejected under 35 USC 102(b) over the disclosure of the Green U.S. Patent No. 4,252,592.

This rejection has been obviated by the foregoing amendments, whereby the recitations of claims 4, 11, 15 and 16 have been inserted into claim 1.

Accordingly, the rejection under 35 USC 102 should be withdrawn.

For the reasons given on pages 3-5 of the Official Action, claims 1-3, 6-8, 10-13, 15, 16 20 and 22 are rejected under 35 USC 103(a) over the disclosures of the Hamazu et al U.S. Patent No.

5,359,017, the Buchwalter et al U.S. Patent No. 5,879,859, the Ohnishi U.S. Patent No. 5,747,599, the Starkey U.S. Patent No. 5,384,339, the Green et al U.S. Patent No. 4,299,938 and the Green U.S. Patent No. 4,252,592.

This rejection is respectfully traversed.

The present invention especially as amended herein, uses a specific compound serving particularly as a photo-thermopolymerization initiator, selected from various compounds which have been conventionally known as photopolymerization initiators. In particular, the present invention includes the specific sulfonium salt described in the amended claim 1.

In the references applied against the claims, there is a disclosure about the photopolymerizable resin components used in the present invention.

However, in the cited references, there is neither any disclosure nor suggestion about the function of the specific sulfonium salt used in the present invention described in the amended claim 1 as a photo-thermopolymerization initiator.

That is, in case of conventional thermo-curing, the ratio of the resin component and the curing agent component is determined stoichiometrically. However, when the ratio exceeds the stoichiometric range, it is difficult to obtain a cured material with excellent physical properties. On the other hand, in case of conventional energy-ray curing, the resin component itself cures with the photopolymerization initiator, but curing will not proceed at all at the depth at which light cannot reach or where no light exists.

✓ On the other hand, the present invention involves both energy-ray curing and thermo-curing. Accordingly, curing proceeds by a chain reaction even at the depth where no light reaches at all, so

that photopolymerizable resin can be cured over a wide composition range. In the cited references, no suggestion is found about a composition with such a function.

Also, the present invention is not merely a composition including the specific sulfonium salt, but it includes the specific curing agent component described in the amended claim. This curing agent component is used at a specific ratio in relation to the resin component. Thereby, the above-described specific sulfonium salt is able to function as the photo-thermopolymerization initiator.

A characteristic of the present invention is the curing capacity-elevating effect brought about by a curing mechanism other than only irradiation with an energy ray. In the present invention an almost simultaneous progress of different curing mechanisms takes place. In particular, energy ray curing and heat curing caused by heat produced during curing result in a fully cured resin, thereby preventing an insufficient amount of curing.

If the curing agent component falls outside the presently claimed amount and its amount is too small, less than a sufficient amount of curing may take place. In contrast, if the amount of curing agent is too large, the amount of resin component available for energy-ray curing is relatively small, and the energy-ray curing capacity is correspondingly small, resulting in less heat generated by energy-ray curing to trigger heat curing. Therefore, the curing characteristics deteriorate.

The cited references fail to suggest the composition of the present claims.

In the rejection under 35 USC 103, it would appear that the references are not applied individually, because (1) it is not expressly-stated that they are applied individually, (2) the connecting term "and" (rather than "or") is used, and (3) the Buchwalter and the Starkey patents are expressly relied upon when the Green '592 patent is applied against the claims.

The rejection under 35 USC 103 improperly combines of too many references.

The rejection does not refer to any motivation for combining the disclosures of the patents.

Therefore, a prima facie case of obviousness has not been made. MPEP 2143.01.

The rejection does not provide sufficient reasons why many of the present claims, such as claims 2, 7, 10-12, 20 and 22, are considered to be obvious over the Hamazu patent, whether viewed alone or in combination with any other disclosure.

✓ The Hamazu patent does not suggest the combination of the present claim 2 calling for both a curing agent and a curing accelerator. There is clearly no suggestion of the particular combination of such components (maleic anhydride and polyethylene glycol) recited in new claim 26.

In the passage at column 5, lines 1-14, maleic anhydride is merely mentioned as being one of a number of optional "auxiliaries". Other "auxiliaries" include bulk fillers, flame retardants, antistatic agents and surfactants.

The rejection does not provide sufficient reasons why many of the present claims, such as claims 2, 3, 6-8, 10-12, 15, 16, 20 and 22, are considered to be obvious over the Buchwalter patent, whether viewed alone or in combination with any other disclosure.

In the Buchwalter patent, maleic anhydride is merely an example of a Lewis acid to be used in a resin for forming a positive resist pattern. See column 6, lines 50-65 of the Buchwalter patent.

✓ There is no motivation to employ such a resist pattern additive as the presently claimed curing agent.

✓ At column 7, lines 5-17 of the Buchwalter patent, various polyethers, such as poly(ethylene glycol), are described as functioning as thickeners or flexibilizer. There is no suggestion in this passage that polyethers function as curing agents or curing accelerators. Polyethers are not described

in the working Examples of the Buchwalter patent. In Example 1, a very small amount of the monomer, ethylene glycol, is present.

The Buchwalter patent does not suggest the combination of the present claim 2 calling for both a curing agent and a curing accelerator. There is clearly no suggestion of the particular combination of such components (maleic anhydride and polyethylene glycol) recited in new claim 26.

An essential ingredient of the resin of the Buchwalter patent is the type of epoxy compound. In particular, this epoxy compound must be an acid-cleavable, acetal type epoxy. See column 2, line 40 to column 2, line 15. Therefore, the embodiments of the present claims 7 and 8 are not obvious over the disclosure of the Buchwalter patent.

The rejection does not provide sufficient reasons why many of the present claims, such as claims 2, 3, 6-8, 10-12, 15, 16, 20 and 22, are considered to be obvious over the Ohnishi patent, whether viewed alone or in combination with any other disclosure.

At column 5, lines 13-17, "curing agents" are included in a large list of optional additives. The particular curing agents recited in the present claims 3-5 are not suggested for use as curing agents in the Ohnishi patent.

✓ The Ohnishi patent does not suggest the combination of the present claim 2 calling for both a curing agent and a curing accelerator. There is clearly no suggestion of the particular combination of such components (maleic anhydride and polyethylene glycol) recited in new claim 26.

The rejection does not provide sufficient reasons why many of the present claims, such as claims 2, 6, 7, 10-12, 20 and 22, are considered to be obvious over the Starkey patent, whether

viewed alone or in combination with any other disclosure.

✓ The Starkey patent would appear to suggest that a host of compounds, including polyols and acid anhydrides, may be added to epoxy resin compositions to enhance cure rates. See column 5, lines 17-19 and column 20, lines 10-13 & 38. However, the working Examples of the Starkey patent seem to suggest rapid cure rates even in the absence of such additives. Therefore, there would not appear to be a strong motivation in the Starkey patent to add any thermohardening catalysts to epoxy resins. There is clearly no motivation to select polyols or acid anhydrides from the very long list of thermohardening catalysts in the passage of the Starkey patent extending from column 20, line 10 to column 21, line 11.

✓ The Starkey patent does not suggest the combination of the present claim 2 calling for both a curing agent and a curing accelerator. There is clearly no suggestion of the particular combination of such components (maleic anhydride and polyethylene glycol) recited in new claim 26.

The rejection does not provide sufficient reasons why many of the present claims, such as claims 2, 7, 10-12, 20 and 22, are considered to be obvious over the Green et al '938 patent, whether viewed alone or in combination with any other disclosure.

In certain Examples, e.g., Example 1 of the Green et al '938 patent, the curable resin is free of non-epoxy curing agents or curing accelerators and complete curing seems to take place by photopolymerization. However, in Example 15 on column 15, the curable resin includes a boron trichloride complex of n-octyldimethylamine as a heat-activated crosslinking agent. The resin of Example 15 is cured in two stages, wherein it is first partially cured by photopolymerization and then finally cured by thermal curing at 120°C for 1 hour.

✓ The Green et al '938 patent does not suggest the combination of the present claim 2 calling for both a curing agent and a curing accelerator. There is clearly no suggestion of the particular combination of such components (maleic anhydride and polyethylene glycol) recited in new claim 26.

The Green et al '938 patent suggests that thermal curing takes place after photopolymerization. See the Abstract and column 12, lines 31-36.

In the rejection, it is stated that the Green '592 patent discloses that the claimed curing agent is capable of curing the photopolymerizable resin (i.e. the cycloaliphatic diepoxide) without irradiation by an energy ray. According to the rejection, it would have been obvious to cure the cycloaliphatic diepoxide compositions of the references in the presence of the acid anhydride such as maleic anhydride of Buchwalter and Starkey in order to ensure complete cure throughout the thickness of the composition.

✓ It would not have been obvious to look to the disclosure of the Buchwalter patent to select maleic anhydride as an additive for the resin of the Green '592 patent. In the Buchwalter patent, maleic anhydride is merely an example of a Lewis acid to be used in a resin for forming a positive resist pattern. See column 6, lines 50-65 of the Buchwalter patent. There is no motivation to employ such a resist pattern additive as a cross-linking agent to thermally cure a photopolymerized epoxy resin as described in the Green '592 patent.

✓ A very long list of thermohardening catalysts is described in the passage of the Starkey patent extending from column 20, line 10 to column 21, line 11. There is no motivation to select an acid

anhydride, such as maleic anhydride, from this long list and to use it as the particular cross-linking agent to thermally cure a photopolymerized epoxy resin as described in the Green '592 patent.

Accordingly, the rejection under 35 USC 103 should be withdrawn. However, in the event that the Examiner is not persuaded to withdraw this rejection, it is respectfully requested that the patents are applied on a claim-by-claim basis, with individual patents or particular combinations of patents being applied in separate rejections. For example, it should be pointed out how an individual reference, or combination of references, is regarded to render claim 26 obvious.

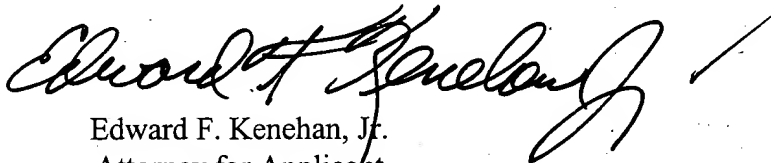
Allowance is requested.

U.S. Serial No. 09/664,332
Attorney Docket No. 001195

In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees which may be due with respect to this paper, may be charged to Deposit Account No. 01-2340.

Respectfully submitted,

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Attachments: Version with markings to show changes made
USPTO website for US 6,376,070

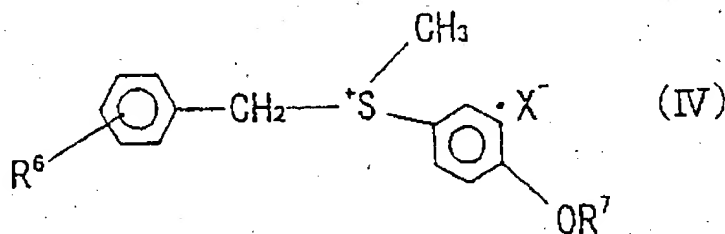
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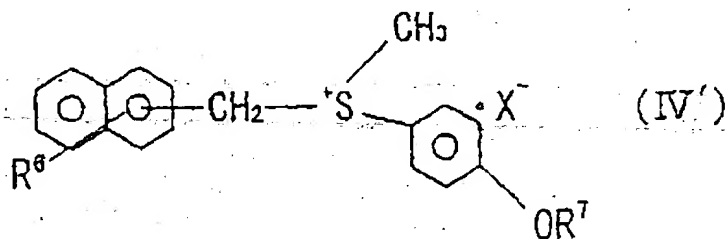
VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

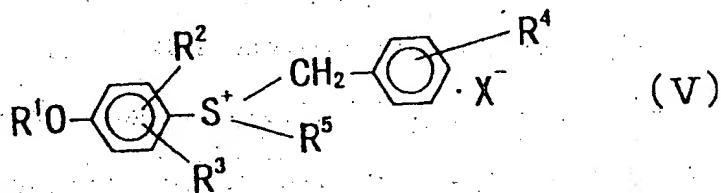
1. (Amended) An energy-ray curing resin composition comprising a photopolymerizable resin component which can be cured by irradiation with an energy ray, a photopolymerization initiator component which makes it possible to cure said photopolymerizable resin component with irradiation of an energy ray, and a curing agent component capable of curing at least one of said photopolymerizable resin components without irradiation of an energy ray,

wherein said curing agent component comprises an acid anhydride or a derivative thereof,
said photopolymerization initiator component comprises a sulfonium salt, the sulfonium salt
being a photo-thermopolymerization initiator which can initiate polymerization by both of light and
heat, and being represented by the following general formula (IV), (IV'), or (V):





in Formula (IV) or (IV') described above, R⁶ represents hydrogen, halogen, a nitro group or a methyl group; R⁷ represent hydrogen, CH₃CO, or CH₃OCO; and X⁻ represents SbF₆⁻, PF₆⁻, AsF₆⁻ or BF₄⁻;



in Formula (V) described above, R¹ represents hydrogen, a methyl group, an acetyl group, or a methoxycarbonyl group; R² and R³ each independently represent hydrogen, halogen or an alkyl group of C₁ to C₄; R⁴ represents hydrogen, halogen or a methoxy group; R⁵ represents an alkyl group

of C₁ to C₄; and x represents SbF₆⁻, PF₆⁻, AsF₆⁻ or BF₄⁻, and

said curing agent component is present with a proportion of 0.1 to 1.4 mol per mol of said photopolymerizable resin component which can react with said curing agent component.

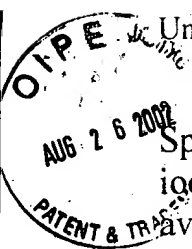
3. (Amended) The energy-ray curing resin composition as described in claim [1] 2, comprising an epoxy resin component having a cyclic ether structure in a molecular structure as the photopolymerizable resin component.

6. (Amended) The energy-ray curing resin composition as described in claim 2, comprising [an acid anhydride or a derivative thereof and] a monohydric or polyhydric [alcohols] alcohol as [the curing agent component or] the curing accelerator component.

7. (Amended) The energy-ray curing resin composition as described in claim 3, wherein [the curing agent component or the] said curing accelerator component comprises a compound which can react with the epoxy resin component and which does not have a nitrogen atom in a molecular structure.

18. (Amended) The energy-ray curing resin composition as described in claim 17, wherein the polymerization initiator component comprising the binary or higher system contains at least one of aryl base sulfonium salts or the iron-allene base compounds [represented by Formula (I), (II) or (III)] as the photopolymerization initiator and at least one of the sulfonium salts represented by Formula (IV), (IV') or (V) as the photo-thermopolymerization initiator.

New claim 26 is added.



Specifically applicable onium salt compounds include aromatic diazonium salts, aromatic iodonium salts, aromatic sulfonium salts, and pyridinium salts. The commercially available onium salt compounds which are applicable to the present invention include OPTOMER-SP-150 (manufactured by Asahi Denka kogyo Ltd.), OPTOMER-SP-151 (manufactured by Asahi Denka kogyo Ltd.), OPTOMER-SP-170 (manufactured by Asahi Denka kogyo Ltd.), OPTOMER-SP-171 (manufactured by Asahi Denka kogyo Ltd.), UVE-1014 (manufactured by General Electronics Corp.), CD-1012 (manufactured by Sartomer Corp.), SUNAID *SI-60L* (Sanshin Chem. Ind. Ltd.), SUNAID SL-80L (Chem. Ind. Ltd.), SUNAID SI-100L (Sanshin Chem. Ind. Ltd.), CI-2064 (manufactured by Nippon Soda Co. Ltd.), CI-2639 (manufactured by Nippon Soda Co. Ltd.), CI-2624 (manufactured by Nippon Soda Co. Ltd.), CI-2481

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